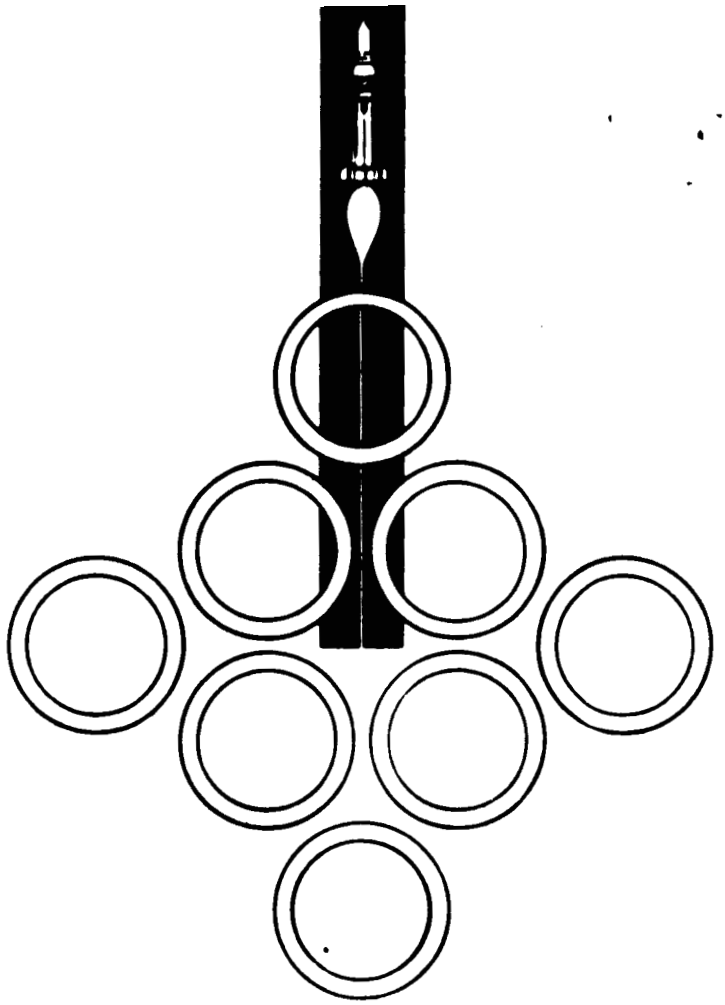

ENGINEERING DEPARTMENT
TECHNICAL REPORT
TR-RE-CCSD-FO-1141-3

TEST REPORT

FOR

PNEUMATIC CYLINDER

Miller Fluid Power Part Number C14616

NASA Drawing Number 75M06909-1, Revision B

GPO PRICE $ _____

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FACILITY FORM 602

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SPACE DIVISION CHRYSLER CORPORATION

COMPONENT DATA	NASA DWG/SPEC/CODE NO.	FILE NO.
	75M06909-1 Rev. B	GENERIC CODE D330102000022
	FIND NO. A31850	COMPLEX 34
	REF DESIG. NO.	SYSTEM Apollo Access Arm
	PRIORITY I	
NOMENCLATURE	MANUFACTURER	SUBSYSTEM
Cylinder, Pneumatic Double Acting	Miller Fluid Power	AAA Pneumatic Control Subsystem
		NHA DWG. NO. 75M06828
CRITICALITY NO.	MFG MODEL NO.	STOCK CODE NO.
CEI NO.	MFG PART NO. C14616	REVISION: DATE 8-20-68
MAINTENANCE MANUAL TM-394-D	MFG DWG NO.	PREPARING ORGANIZATION Chrysler Corporation

SPECIFICATION REQUIREMENTS:

Size: Bore-2.50 in., length 54.35 in., stroke-40.0 in., rod dia. -1.75 in.
Service Media: GN_2
Operating Pressure: 750 psig
Proof Pressure: 1500 psig
Burst Pressure: 3000 psig
Leakage: 5 scim max.
Body: CRES
Seals: Hycar
Lubrication: KEL-F-10 or DC-55
Operating Temperature: 0° to 160°F

FUNCTION:

This component is used to position the white room on to the spacecraft.

ASSESSMENT & RECOMMENDATIONS:

The component met the specification requirements during all tests and is considered qualified for its intended application.

TEST HISTORY:

TEST REPORT NO.	TEST TYPE	REMARKS
TR-RE-CCSD-FO-1141-3	Proof Pressure	Satisfactory
	Functional	Satisfactory
	Vibration	Satisfactory
	Salt Fog	Satisfactory
	Cycle	Satisfactory
	Burst	Satisfactory

SERVICE HISTORY:

Cylinder has been used on LC-34 during S-IB program.

One UCR has released due to internal leakage past the "O" ring seal

TEST REPORT

FOR

PNEUMATIC CYLINDER

Miller Fluid Power Part Number C14616

NASA Drawing Number 75M06909-1, Revision B

ABSTRACT

This report presents the results of tests performed on three specimens of Pneumatic Cylinder 75M06909-1. The following tests were performed:

1. Receiving Inspection
2. Proof Pressure
3. Functional
4. Vibration
5. Salt Spray
6. Cycle
7. Burst

The performance of each test specimen was in accordance with the requirements of NASA Drawing 75M06909-1, Revision B, and test procedure TP-RE-CCSD-FO-1141-2 throughout the test program.

TEST REPORT

FOR

PNEUMATIC CYLINDER

Miller Fluid Power Part Number C14616

NASA Drawing Number 75M06909-1, Revision B

May 24, 1968

CHRYSLER CORPORATION SPACE DIVISION - NEW ORLEANS, LOUISIANA

FOREWORD

The tests reported herein were conducted for the John F. Kennedy Space Center by Chrysler Corporation Space Division (CCSD), New Orleans, Louisiana. This document was prepared by CCSD under contract NAS 8-4016, Part VII, CWO 271620.

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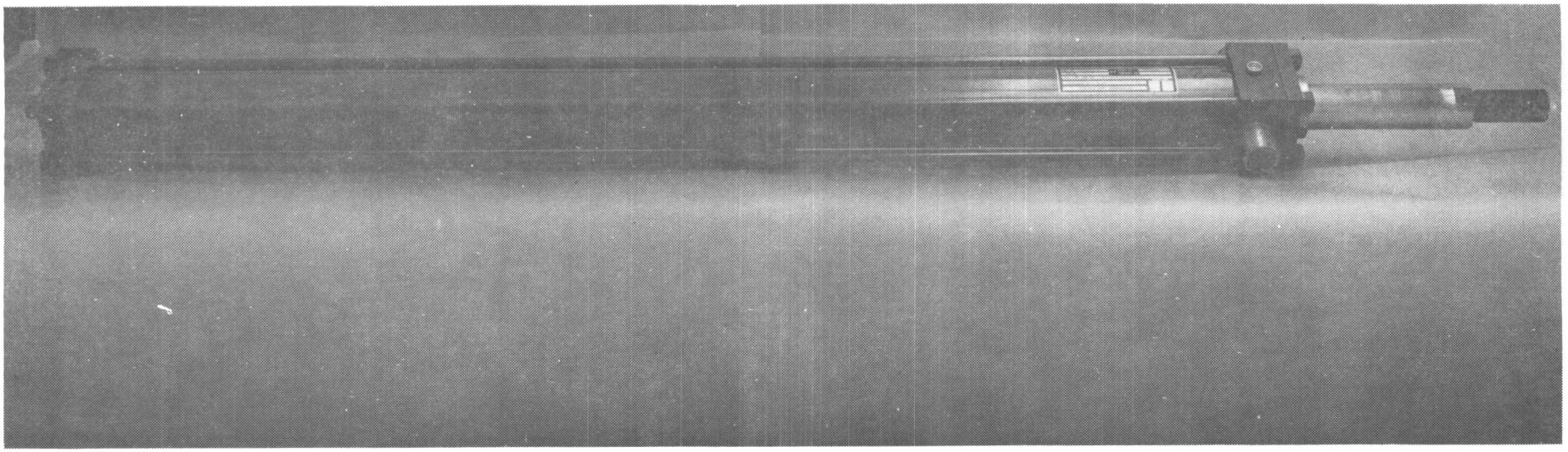


Pneumatic Cylinder, 75M06909-1 Revision B

CHECK SHEET

FOR

PNEUMATIC CYLINDER

MANUFACTURER: Miller Fluid Power
MANUFACTURER'S PART NUMBER: C14616
NASA DRAWING NUMBER: 75M06909-1, Revision B
TESTING AGENCY: Chrysler Corporation Space Division, New Orleans, La.
AUTHORIZING AGENCY: NASA KSC

I. FUNCTIONAL REQUIREMENTS

A.	OPERATING MEDIUM	GN_2
B.	OPERATING PRESSURE:	750 psig
C.	LEAKAGE:	5 scim maximum
D.	PROOF PRESSURE:	1500 psig
E.	BURST PRESSURE	3000 minimum

II. CONSTRUCTION

A.	BODY:	CRES
B.	SEALS:	Hycar
C.	LUBRICATION:	KEL-F-10 or DC-55

III. ENVIRONMENTAL CHARACTERISTICS

A.	OPERATING TEMPERATURE RANGE:	0 to 160°F

IV. LOCATION AND USE: Apollo Access Arm

TEST SUMMARY

PNEUMATIC CYLINDER

75M06909-1, Revision B

Environment	Units	Operational Boundary	Test Objective	Test Results	Remarks
Proof Pressure	3	1500 psig	Check for leakage and distortion	Satis-factory	No leakage or distortion
Functional Test	3	190 psig 750 psig	Determine force developed. Extend and retract stroke and check for leakage	Satis-factory	
Vibration Test Sinusoidal Random	2	10 to 20 cps at 0.2 inches D. A. 20 to 90 cps at 4.0 g peak 90 to 150 cps at 0.01 inches D. A. 150 to 2000 cps at 10.0 g peak 10 to 2000 cps at 0.08 g^2/cps	Determine if specimen operation is impaired by vibration	Satis-factory	
Salt Fog Test	1	240 hours ($\pm$ 2 hours) exposure to an atomized salt solution	Determine if specimen operation is impaired by salt fog exposure	Satis-factory	
Cycle Test	3	5000 cycles	Determine if specimen operation is impaired by cycling	Satis-factory	
Burst Test	1	3000 psig (minimum)	Determine if specimen will maintain burst pressure without leakage and distortion	Satis-factory	

SECTION I

INTRODUCTION

1.1 SCOPE

1.1.1 This report describes the results of tests performed to determine if Pneumatic Cylinder 75M06909-1 meets the operational and environmental requirements for John F. Kennedy Space Center Launch Complexes 34 and 37. A summary of the test results is presented on page ix.

1.1.2 Three pneumatic cylinders were numbered Specimens 1 through 3 for identification. Table 1-1 lists the tests performed, the specimen used for each test, and the test media, when applicable.

1.2 ITEM IDENTIFICATION

1.2.1 Pneumatic Cylinder 75M06909-1 is manufactured by Miller Fluid Power Company. The cylinder is 54.35 inches ($\pm$ .060 inch) long and has a 2.5-inch bore, with a 40 inch stroke. The cylinder is constructed of corrosion resistant steel. It has an operating pressure of 750 psig and is rated for use with gaseous nitrogen. The pneumatic cylinder is used on the Apollo access arm installation.

1.3 APPLICABLE DOCUMENTS

1.3.1 The documents used during this test program are as follows:

a. 75M06909-1, Component Specification

b. KSC-STD-164(D), Environmental Test Methods

c. Cleaning Standard MSFC-STD-164

d. Test Plan CCSD-FO-1141

e. Test Procedure TP-RE-CCSD-FO-1141-2

Table 1-1. Test Sequence and Media

Tests	Specimens			Medium
	1	2	3	
Receiving Inspection	X	X	X	
Proof Pressure	X	X	X	GN_2
Functional	X	X	X	GN_2
Vibration	X	X		
Salt Spray			X	
Cycle	X	X	X	GN_2
Burst	X			Water

SECTION II

RECEIVING INSPECTION

2.1 REQUIREMENTS

2.1.1 Test Specimens 1, 2 and 3 shall be checked for conformance with NASA Drawing 75M06909-1 and applicable specifications to the extent possible without disassembly of the test specimen. The specimen shall also be inspected for poor workmanship and manufacturing defects.

2.2 PROCEDURE

2.2.1 Test Specimens 1, 2 and 3 were inspected for conformance with NASA Drawing 75M06909-1.

2.2.2 The specimens were inspected for defective threads and welds.

2.2.3 The specimens were inspected for damage to cylinder.

2.2.4 The specimens were inspected for poor workmanship and manufacturing defects.

2.3 TEST RESULTS

The three specimens complied with NASA Drawing 75M06909-1 and Miller Fluid Power Drawing Number 4177. No evidence of poor workmanship or manufacturing defects were observed.

2.4 TEST DATA

The data presented in table 2-1 were recorded during the receiving inspection.

Table 2-1. Specimen Specifics

Name	Pneumatic Cylinder
Type	Double Acting
Model	H-81
Length	54.35-inches
Bore	2.50-inches
Stroke	40.0-inches
Piston Rod Dia.	1.75-inches
Service Media	GN_2

SECTION III

PROOF PRESSURE TEST

3.1 TEST REQUIREMENTS

3.1.1 Test Specimens 1, 2 and 3 shall be subjected to a proof pressure of 1500 psig.

3.1.2 The pressurizing medium shall be GN_2.

3.1.3 Proof pressure shall be maintained for five minutes.

3.1.4 Leakage or distortion, or both, shall be monitored during this test.

3.2 TEST PROCEDURE

3.2.1 The test specimens were installed as shown in figure 3-1 utilizing the equipment listed in table 3-1.

3.2.2 With the cylinder in midstroke position, both pressure ports were simultaneously pressurized to 1500 psig.

3.2.3 Each test specimen was subjected to the proof pressure test for five minutes.

3.2.4 The specimen was checked for leakage and distortion.

3.2.5 The pressure was vented and each test specimen was inspected for structural deformities.

3.2.6 All test data were recorded.

3.3 TEST RESULTS

The test specimens successfully withstood the proof pressure test. No leakage or distortion was noted.

3.4 TEST DATA

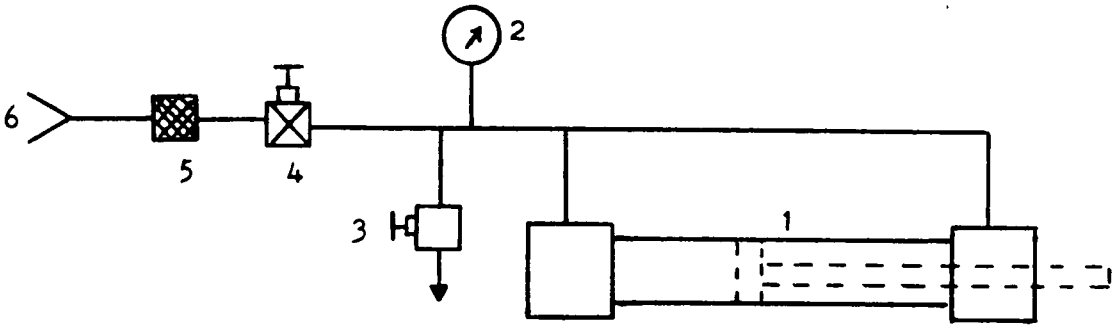
The data recorded during the proof pressure tests are presented in table 3-2.

Table 3-1. Proof Pressure Test Equipment List

Item No.	Item	Manufacturer	Model/ Part No.	Serial No.	Remarks
1	Test Specimen	Miller Fluid Power	C14616	1, 2 and 3	
2	Pressure Gage	Heise	NA	200594-I	0 to 3000 psig Cal date: 12/4/67
3	Hand Valve	Robbins Aviation	SSKG-250	NA	¼-inch
4	Regulator	Tescom	26-1003	1004	0 to 4000 psig
5	Filter	Bendix	2-S-1346 0-16-B-0	NA	2-micron
6	GN_2 Supply				

Table 3-2. Proof Pressure Test Data (All Specimens)

Test Media	GN_2
Pressure	1500 psig
Duration	5 minutes
Leakage	None
Distortion	None



Note: Refer to table 3-1 for item identification.

Figure 3-1. Proof Pressure Test Schematic

SECTION IV

FUNCTIONAL TEST

4.1 TEST REQUIREMENTS

4.1.1 A functional test shall be conducted on test Specimens 1, 2 and 3.

4.1.2 Alternately pressurize the extend and retract ports of the specimen with GN_2 until the cylinder is fully extended or retracted. Perform three cycles on each specimen.

4.1.3 Slowly pressurize the extend port to 190 psig and check the retract port for leakage. Leakage shall not exceed 5 scim.

4.1.4 Repeat the step described in paragraph 4.1.3 except pressurize the retract port to 750 psig and check the leakage at the extend port and shaft seal.

4.1.5 Pressurize the extend port to 190 psig and measure the force developed. Piston shall be at midstroke position.

4.1.6 Pressurize the retract port to 750 psig and measure the force developed. Piston shall be at midstroke position.

4.2 TEST PROCEDURE

4.2.1 The test specimen was installed in the test setup as shown in figures 4-1 and 4-2 utilizing the equipment listed in table 4-1.

4.2.2 It was determined that all connections were tight, gages were installed and operating properly, and all valves were closed.

4.2.3 Hand valves 5, 6 and 8 and solenoid valve 14 were opened. Regulator 4 was slowly adjusted until the specimen was extended. Solenoid valve 14 and hand valve 8 were closed.

4.2.4 Hand valve 7 and solenoid valve 15 were opened. Regulator 4 was slowly adjusted until the specimen retracted. Solenoid valve 15 and hand valve 7 were closed.

4.2.5 Steps 4.2.2 through 4.2.4 were repeated three times.

4.2.6 Load cell 13 and flowmeters 11 and 12 were installed.

4.2.7 Hand valve 8 and solenoid valve 14 were opened. Regulator 4 was adjusted until gage 9 indicated 190 psig. The force developed as indicated by load cell 13 and the leakage indicated by flowmeter 12 were recorded. Solenoid valve 14 and hand valve 8 were closed.

4.2.8 Hand valve 7 and solenoid valve 15 were opened. Regulator 4 was adjusted until gage 10 indicated 750 psig. The force developed as indicated by load cell 13 and the leakage indicated by flowmeter 11 were recorded. The system was vented. Hand valve 7 and solenoid valve 15 were closed.

4.2.9 Steps 4.2.7 and 4.2.8 were repeated as necessary to obtain consistant data.

4.2.10 All test data were recorded.

4.3 TEST RESULTS

All three test specimens successfully met the functional test requirements.

4.4 TEST DATA

Data recorded during the functional test are presented in tables 4-2 through 4-4.

Table 4-1. Functional Test Equipment List

Item No.	Item	Manufacturer	Model/ Part No.	Serial No.	Remarks
1	Test Specimen	Miller Fluid Power	C14616	1,2,3	Pneumatic
2	GN_2 Supply				
3	Filter	Bendix	2-S-1346 0-16-B-0	59	2-micron
4	Regulator	Tescom	26-1002	104	0 to 3000 psig
5	Hand Valve	Robbins Aviation	SSKG-250	NA	¼-inch
6	Hand Valve	Robbins Aviation	SSKG-250	NA	¼-inch
7	Hand Valve	Robbins Aviation	SSKG-250	NA	¼-inch
8	Hand Valve	Robbins Aviation	SSKG-250	NA	¼-inch
9	Pressure Gage	Heise	NA	200594H	0 to 1000 psig ±0.5% FS accuracy Cal date 12-4-67
10	Pressure Gage	Heise	NA	014222	0 to 1000 psig ±0.5% FS accuracy Cal date 11-12-67
11	Flowmeter	Fisher Porter	6306437 03-A12	NA	0 to 10 scim
12	Flowmeter	Fisher Porter	6306437 03-A12	NA	0 to 10 scim
13	Load Cell	Revere Corp.	C46240	144996	0 to 3000 lbs Cal. date 3-15-68
14	Solenoid Valve	Marotta	MV 74	NA	¼-inch
15	Solenoid Valve	Marotta	MV 74	NA	¼-inch
16	Pressure Gage	Heise	NA	200594I	0 to 3000 psig ±0.5% FS accuracy Cal date 12-4-67

Table 4-2. Functional Test Data (Specimen 1)

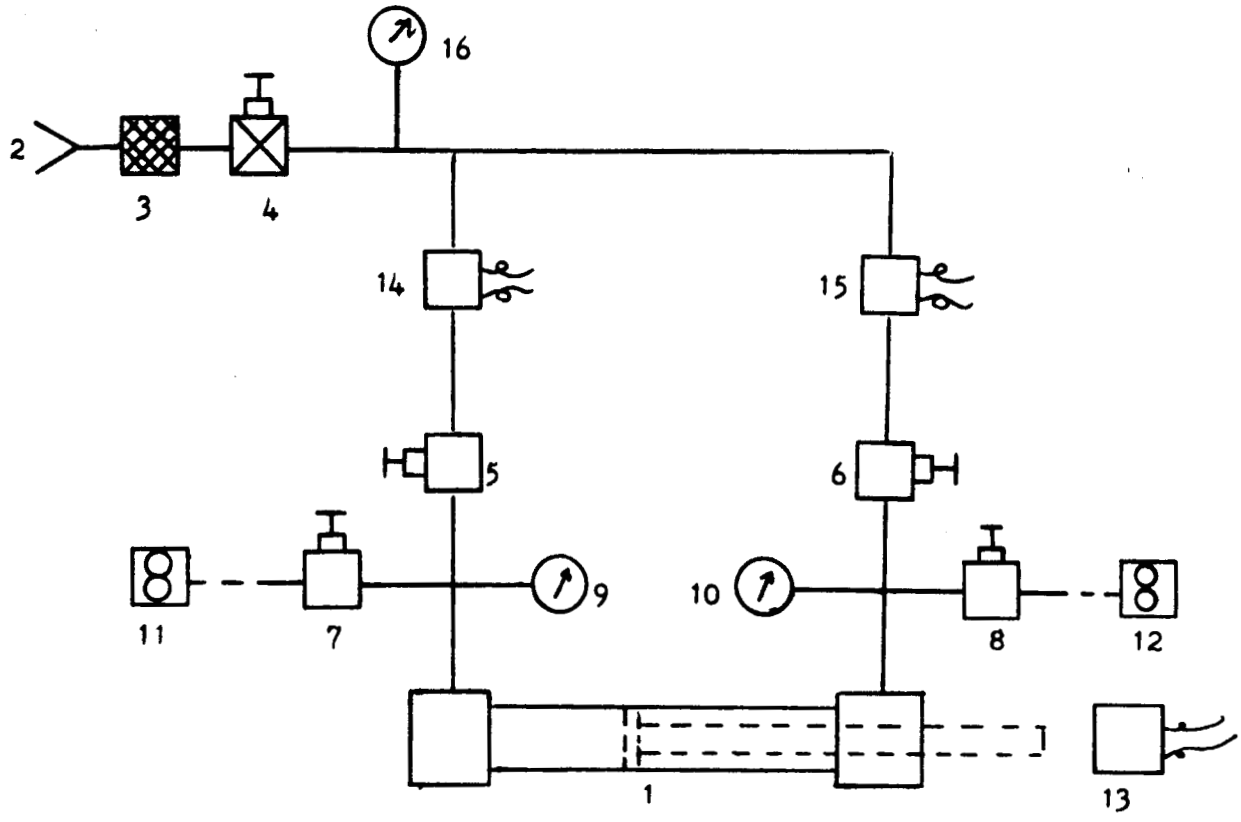
PORT PRESSURIZED	RUN NO.	FORCE DEVELOPED (lbs)	LEAKAGE (scim)
EXTEND	1	900	0
	2	900	0
	3	905	0
RETRACT	1	1745	0
	2	1750	0
	3	1750	0

Table 4-3. Functional Test Data (Specimen 2)

PORT PRESSURIZED	RUN NO.	FORCE DEVELOPED (lbs)	LEAKAGE (scim)
EXTEND	1	905	0
	2	905	0
	3	905	0
RETRACT	1	1775	0
	2	1775	0
	3	1775	0

Table 4-4. Functional Test Data (Specimen 3)

PORT PRESSURIZED	RUN NO.	FORCE DEVELOPED (lbs)	LEAKAGE (scim)
EXTEND	1	900	0
	2	900	0
	3	900	0
RETRACT	1	1750	0
	2	1750	0
	3	1750	0



Note: Refer to table 4-1 for item identification.

Figure 4-1. Functional Test Schematic

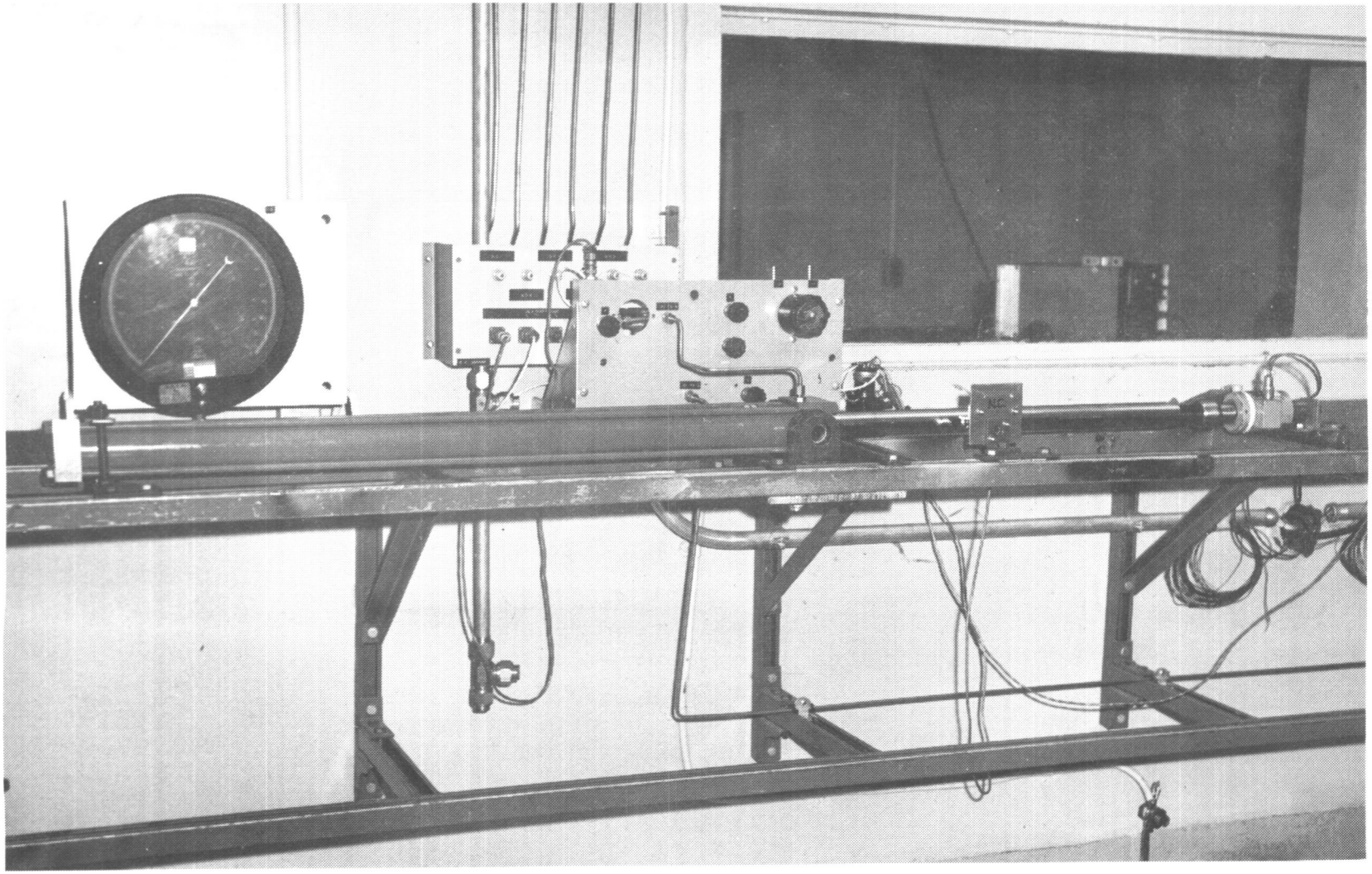


Figure 4-2. Functional Test Setup

SECTION V

VIBRATION TEST

5.1 TEST REQUIREMENTS

5.1.1 A vibration test shall be conducted on the specimen while unpressurized and locked in retract position. Vibration shall be applied along two axes (longitudinal and lateral). The test shall be conducted in accordance with KSC-STD-164(D), Section 9, Procedure I, with the exception that the specimen shall not be operated during vibration. Vibration levels shall be as specified in GP-320, zone 3.2.4.

5.1.2 SINUSOIDAL SWEEP

5.1.2.1 In one 20-minute sweep, the frequency range shall be scanned logarithmically from 10 to 2000 to 10 cps. Critical frequencies of the test specimen shall be noted. The sinusoidal sweep input levels shall be as shown in table 5-1.

Table 5-1. Sinusoidal Vibration Levels

Frequency (cps)	Displacement (Inch DA)	Acceleration (g)
10 to 20	0.2	- -
20 to 90	- -	4.0
90 to 150	0.01	- -
150 to 2000	- -	10.0

5.1.3 RANDOM EXCITATION

5.1.3.1 The test specimen shall be exposed to random vibration at the specified levels over a frequency range from 10 to 2000 cps for a period of 5 minutes. The specified random input levels shall be as shown in table 5-2.

Table 5-2. Random Vibration Levels

Frequency (cps)	Slope (db/octave)	PSD (g^2/cps)
10 to 2000	- -	0.08

5.1.4 Acceleration shall be measured at the test assembly by accelerometers mounted on the assembly.

5.1.5 The vibration test shall be conducted in two axes. The previously described testing is for one axis and shall be completed before proceeding to the next axes.

5.2 TEST PROCEDURE

5.2.1 The test specimen was mounted on the vibration system for vibration as shown in figures 5-4 and 5-5 utilizing the equipment listed in table 5-3.

5.2.2 The specimen was unpressurized and locked in retract position during all periods of vibration.

5.2.3 Following completion of vibration testing, a functional test was performed.

5.3 TEST RESULTS

The Specimens, Numbers 1 and 2, successfully withstood vibration in the longitudinal axis. During the lateral axis of vibration the barrel rotated in the end cap on both specimens. The degree of rotation was 8.50 degrees on Specimen Number 1 and 7.0 degrees on Specimen Number 2. Specimen Numbers 1 and 2 successfully met the post vibration functional test requirements.

5.4 TEST DATA

Post vibration functional test data are presented in tables 5-4 and 5-5.

Table 5-3. Vibration Test Equipment List

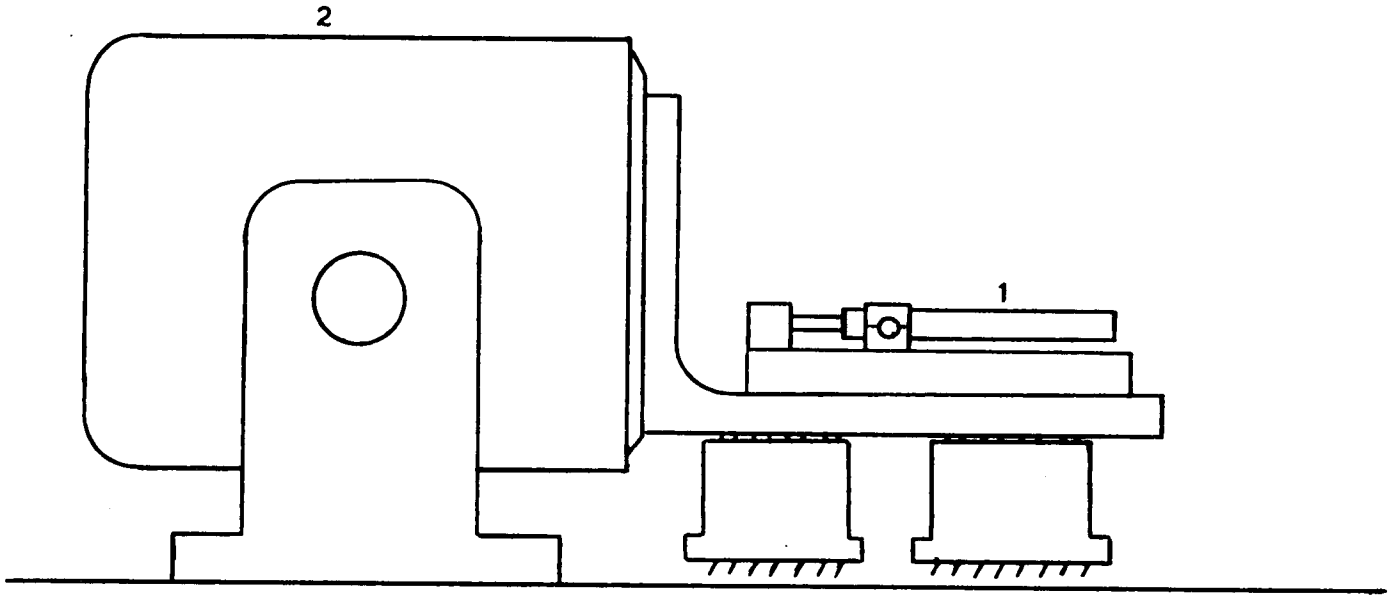
Item No.	Item	Manufacturer	Model/ Part No.	Serial No.	Remarks
1	Test Specimen	Miller Fluid Power	C14616	1 and 2	
2	Vibration Exciter	MB Vibration Equipment	C-210		

Table 5-4. Post Vibration Functional Test Data (Specimen 1)

PORT PRESSURIZED	RUN NO.	FORCE DEVELOPED (lbs)	LEAKAGE (scim)
EXTEND	1	890	0
	2	895	0
	3	895	0
RETRACT	1	1745	0
	2	1750	0
	3	1750	0

Table 5-5. Post Vibration Functional Test Data (Specimen 2)

PORT PRESSURIZED	RUN NO.	FORCE DEVELOPED (lbs)	LEAKAGE (scim)
EXTEND	1	870	0
	2	870	0
	3	875	0
RETRACT	1	1750	0
	2	1750	0
	3	1750	0



Note: Refer to table 5-3 for item identification

Figure 5-1. Vibration Test Schematic

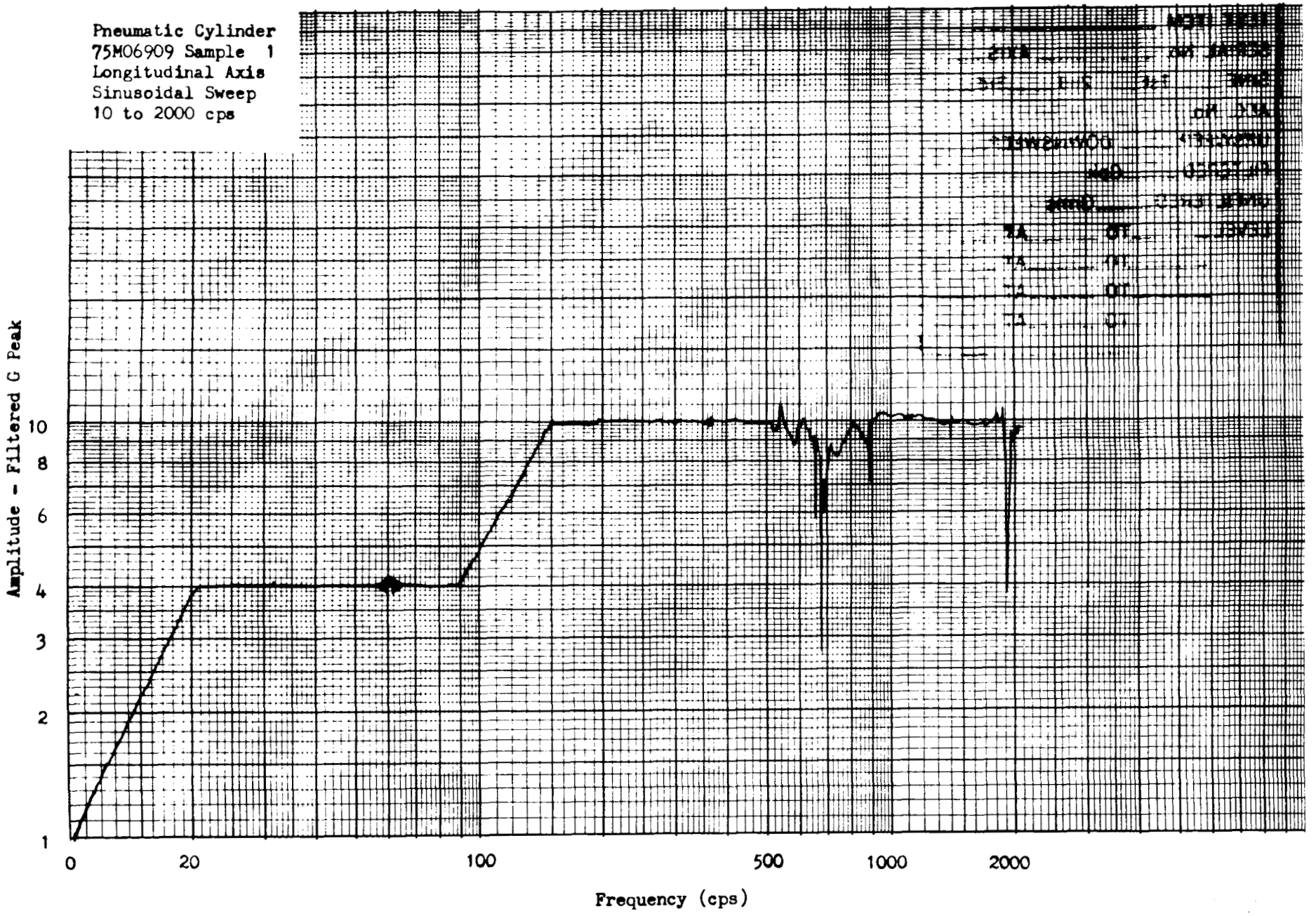


Figure 5-2. Typical Sinusoidal Vibration Plot - Control Accelerometer

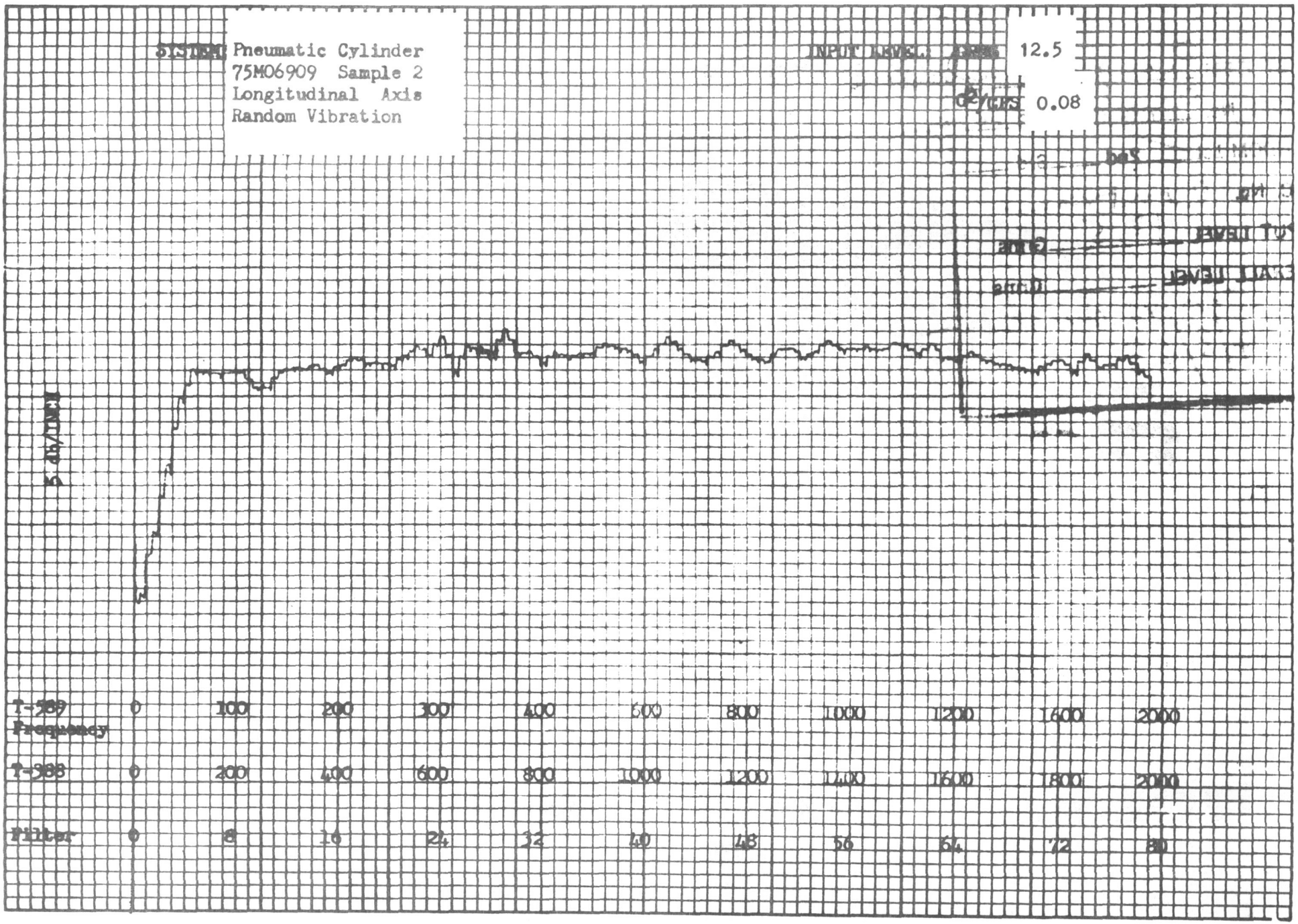


Figure 5-3. Typical Random Vibration Plot - Control Accelerometer

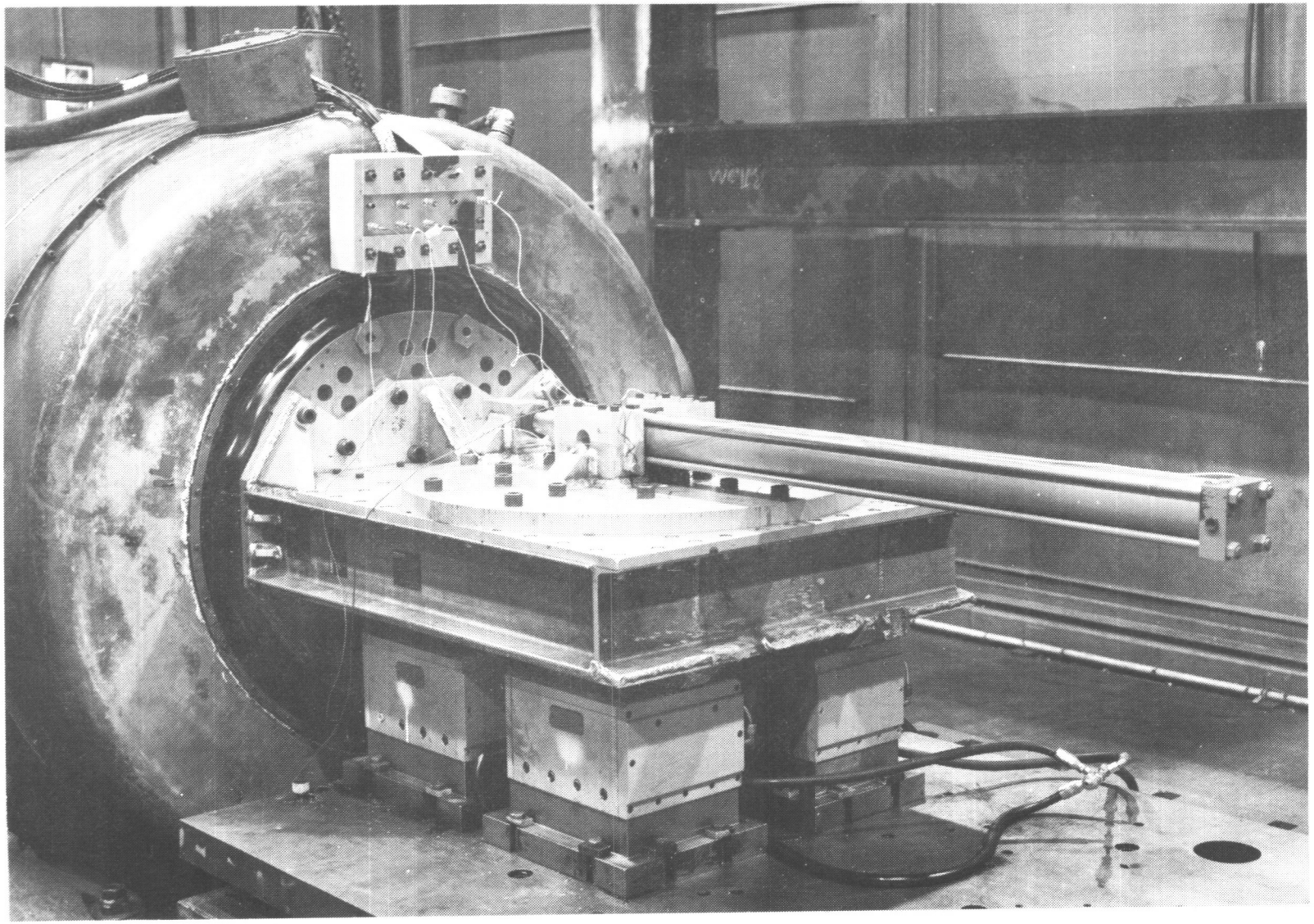


Figure 5-4. Vibration Test Setup Longitudinal Axis

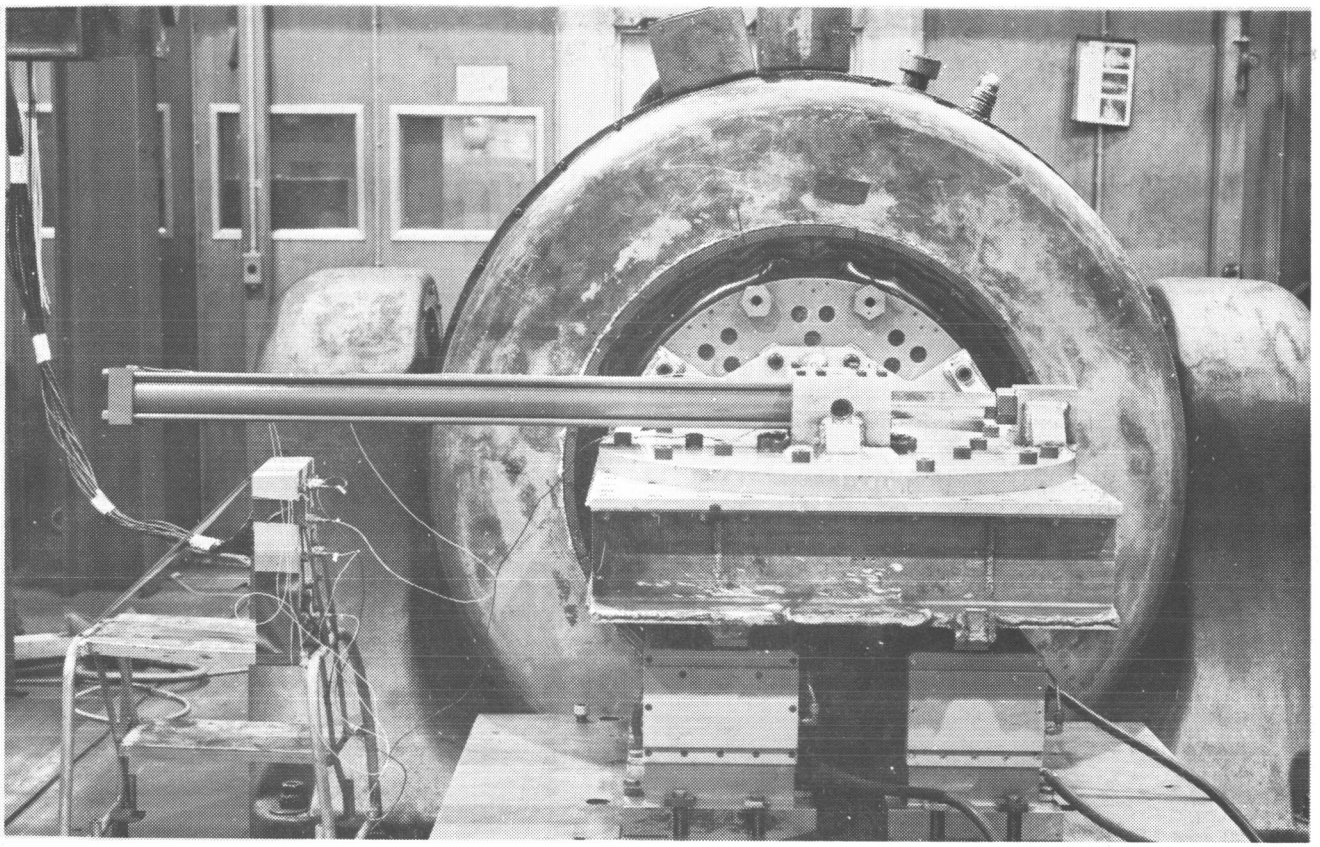


Figure 5-5. Vibration Test Setup Lateral Axis

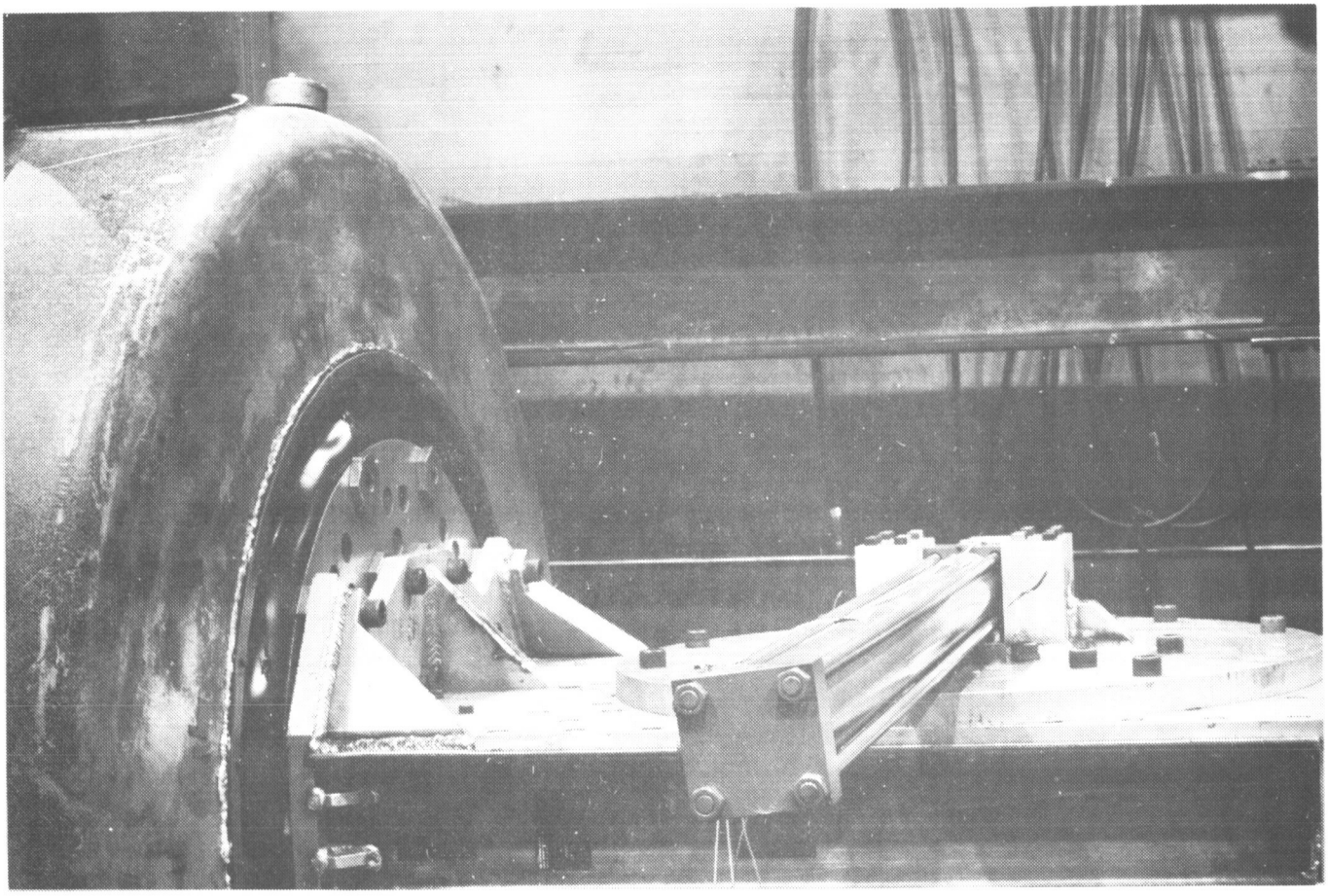


Figure 5-6. Cylinder Barrel Rotation

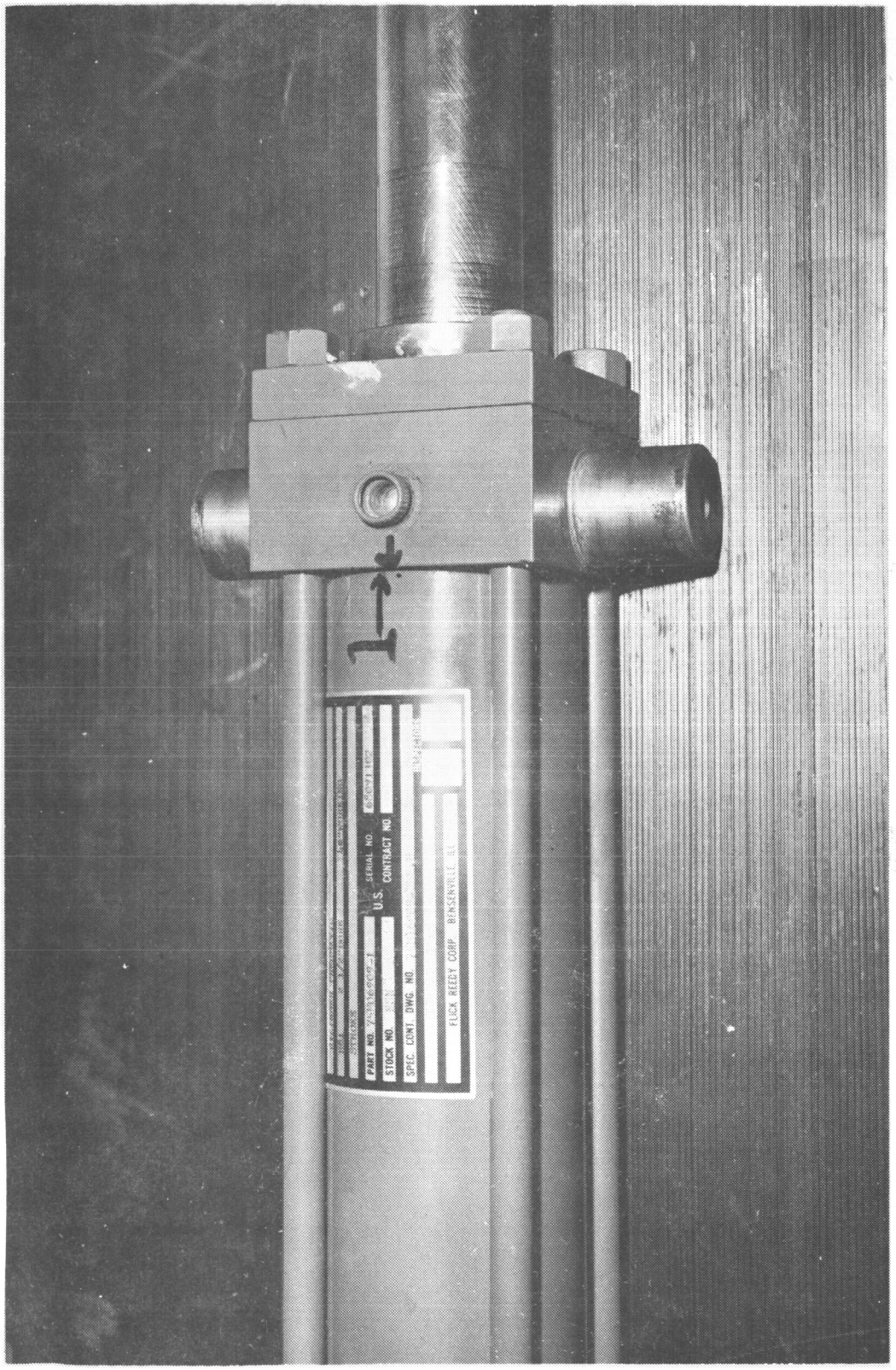


Figure 5-7. Barrel Rotation Specimen 1 - 8.50 Degrees

SECTION VI

SALT FOG TEST

6.1 TEST REQUIREMENTS

6.1.1 Test Specimen 3 shall be subjected to a salt spray test. The test specimen shall be placed in a test chamber with all additional equipment described in KSC-STD-164(D). For 240 hours (± 2 hours) the cylinders shall be subjected to an atomized salt solution.

6.1.2 The solution shall contain five parts by weight of salt in 95 parts by weight of water with no more than 200 parts per million of total solids. The specific gravity of the salt solution shall be from 1.023 to 1.037 with a reference temperature of 95°F (+2, -4)°F. The salt solution shall also have a pH value of 6.5 to 7.2 diluted chemically pure (C.P.) hydrochloric acid of (C.P.) sodium hydroxide may be used to adjust the value of the pH.

6.1.3 Measurements of the characteristics of the salt solution shall be made according to KSC-STD-164(D).

6.1.4 Following the 240-hour exposure, the test specimens shall be subjected to a functional test within one hour after returning to room ambient conditions.

6.2 TEST PROCEDURE

6.2.1 The test specimen was visually inspected for corrosion, dirt, and oily films. Unnecessary oily films and dirt particles were removed and spots of corrosion noted.

6.2.2 With the ports capped, the test specimen was placed in a salt fog chamber.

6.2.3 The chamber was adjusted so that the temperature was 95°F (+ 4, - 2)°F and so that the clean fog collecting receptacle in the exposure zone would collect from 0.5 to 3 milliliters of solution per hour for each 80 square centimeters of horizontal collecting area.

6.2.4 These conditions were maintained for 240-hours (± 2 hours).

6.2.5 At the end of the 240-hour period, the test specimen was removed from the chamber and the specimen allowed to return to room ambient conditions.

6.2.6 Salt deposits were removed in order to make necessary mechanical connections.

6.2.7 Within one hour after returning the specimen to room ambient conditions, a functional test as specified in Section IV was performed.

6.2.8 All test data were recorded.

6.3 TEST RESULTS

An excessive amount of surface rust was noted on the specimen after salt fog exposure (see figure 6-1), however post salt fog functional test results were satisfactory.

6.4 TEST DATA

Functional test data, recorded after the salt fog test, are presented in table 6-2.

Table 6-1. Salt Fog Test Equipment List

Item No.	Item	Manufacturer	Model/ Part No.	Serial No.	Remarks
1	Test Specimen	Miller Fluid Power	C14616	3	
2	Salt Fog Chamber	Industrial Filter & Pump MFG. Co.	411-1C	004372	

Table 6-2. Post Salt Fog Test Functional Test Data Specimen 3

PORT PRESSURIZED	RUN NO.	FORCE DEVELOPED (lbs)	LEAKAGE (scim)
EXTEND	1	920	0
	2	920	0
	3	920	0
RETRACT	1	1770	0
	2	1775	0
	3	1775	0

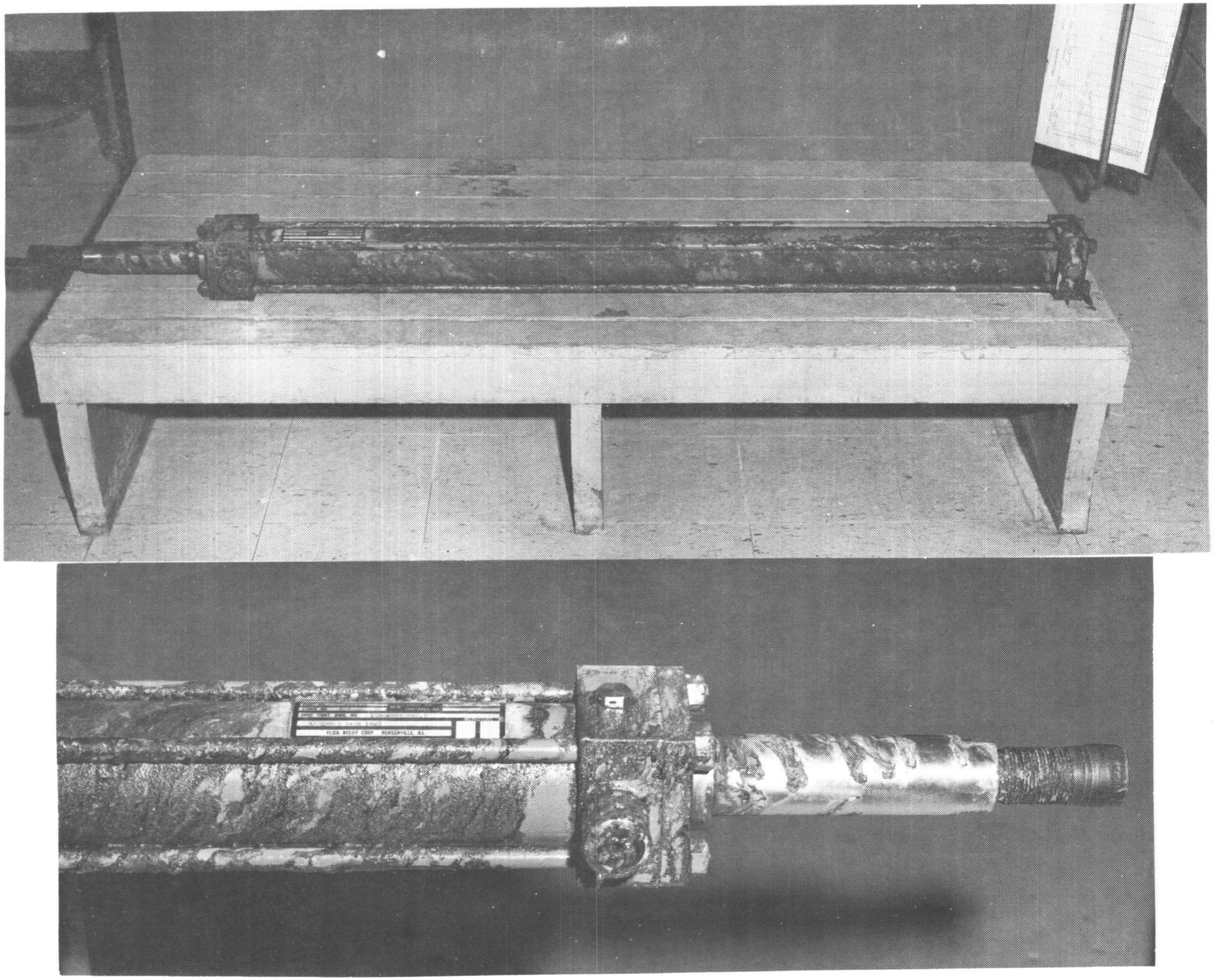


Figure 6-1. Specimen 3 After Exposure To Salt Fog Test

SECTION VII

CYCLE TEST

7.1 TEST REQUIREMENTS

7.1.1 A cycle test shall be performed on test Specimens 1, 2 and 3 to determine whether the environment causes degradation or deformation.

7.1.2 The test specimen shall be subjected to 5,000 cycles, with a 75 percent pound load applied as determined by the initial functional test. Each cycle shall consist of slowly extending, then retracting the cylinder.

7.1.3 A functional test shall be performed after 50, 100, 500 and 1,000 cycles and each 1,000 cycles thereafter.

7.2 TEST PROCEDURE

7.2.1 The test specimen was installed in the setup as shown in figures 7-1 and 7-2 utilizing the equipment listed in table 7-1.

7.2.2 It was determined that all connections were tight, gages installed and operating properly, and all valves were closed.

7.2.3 Regulator 4 was adjusted until 750 psig was indicated on gage 8. Regulator 5 was adjusted until 190 psig was indicated on gage 7. Hand valves 9 and 10 were opened.

7.2.4 Regulator 6 was opened and pressure regulators 13 and 14 adjusted to supply calibrated cylinder 19 with the pressure required to maintain 75 percent of the force developed by the test specimen.

7.2.5 Cycle timer 20 was adjusted for proper sequencing of solenoid valves 11, 12, 17 and 18.

7.2.6 Cycling was commenced and hand valves 9 and 10 were adjusted as necessary for smooth operation.

7.2.7 Extension and retraction of the test specimen constituted one cycle. 5,000 cycles were performed.

7.2.8 The specimen was visually inspected and functionally tested after 50, 100, 500, 1,000, 2,000, 3,000, 4,000 and 5,000 cycles.

7.2.9 All test data were recorded.

7.3 TEST RESULTS

Each specimen was subjected to 5,000 cycles and successfully withstood the cycle test.

7.4 TEST DATA

Functional test data, recorded during the test, are presented in tables 7-2 through 7-27.

Table 7-1. Cycle Test Equipment List

Item No.	Item	Manufacturer	Model/ Part No.	Serial No.	Remarks
1	Test Specimen	Miller Fluid Power	C14616	1,2& 3	Pneumatic Cyl. Double Acting
2	GN_2 Supply				
3	Filter	Bendix	2-S-1346 0-16-B-0	59	2-micron
4	Regulator	Tescom	26-1003	1004	0 to 4000 psig
5	Regulator	Tescom	26-1003	1007	0 to 4000 psig
6	Regulator	Tescom	26-1003	1006	0 to 2500 psig
7	Pressure Gage	Heise	NA	014222	0 to 1000 psig ±0.5% FS accuracy Cal. date 11-12-67
8	Pressure Gage	Heise	NA	200594H	0 to 1000 psig ±0.5% FS accuracy Cal. date 12-4-67
9	Hand Valve	Robbins Aviation	SSKG-250	NA	¼-inch
10	Hand Valve	Robbins Aviation	SSKG-250	NA	¼-inch
11	Solenoid Valve	Marotta	MV 74	NA	¼-inch
12	Solenoid Valve	Marotta	MV 74	NA	¼-inch
13	Pressure Regulator	Grove	94RR	R93476	Internal Relief
14	Pressure Regulator	Grove	94RR	R93477	Internal Relief
15	Pressure Gage	Heise	NA	200594I	0 to 3000 psig ±0.5% FS accuracy Cal. date 12-4-67
16	Pressure Gage	Heise	NA	951569-B	0 to 1000 psig ±0.5% FS accuracy Cal. Date 2-6-68

Table 7-1. Cycle Test Equipment List (Continued)

Item No.	Item	Manufacturer	Model/ Part No.	Serial No.	Remarks
17	Solenoid Valve	Marotta	MV 74	NA	¼-inch
18	Solenoid Valve	Marotta	MV 74	NA	¼-inch
19	Calibrated Cylinder	Pneudraulics Inc.	709	NA	Pneumatic Cylinder Double Acting
20	Cycle Timer	G. C. Wilson Co.	101	NA	
21	Counter	Durant MFG. Co.	5YE8949	266	

Table 7-2. Post 50 Cycles Functional Test Data (Specimen 1)

PORT PRESSURIZED	RUN NO.	FORCE DEVELOPED (lbs)	LEAKAGE (scim)
EXTEND	1	900	0
	2	900	0
	3	900	0
RETRACT	1	1745	0
	2	1745	0
	3	1750	0

Table 7-3. Post 100 Cycles Functional Test Data (Specimen 1)

PORT PRESSURIZED	RUN NO.	FORCE DEVELOPED (lbs)	LEAKAGE (scim)
EXTEND	1	900	0
	2	900	0
	3	900	0
RETRACT	1	1740	0
	2	1745	0
	3	1745	0

Table 7-4. Post 500 Cycles Functional Test Data (Specimen 1)

PORT PRESSURIZED	RUN NO.	FORCE DEVELOPED (lbs)	LEAKAGE (scim)
EXTEND	1	930	0
	2	940	0
	3	945	0
RETRACT	1	1745	0
	2	1740	0
	3	1745	0

Table 7-5. Post 1000 Cycles Functional Test Data (Specimen 1)

PORT PRESSURIZED	RUN NO.	FORCE DEVELOPED (lbs)	LEAKAGE (scim)
EXTEND	1	920	0
	2	920	0
	3	925	0
RETRACT	1	1715	0
	2	1720	0
	3	1715	0

Table 7-6. Post 2000 Cycles Functional Test Data (Specimen 1)

PORT PRESSURIZED	RUN NO.	FORCE DEVELOPED (lbs)	LEAKAGE (scim)
EXTEND	1	930	0
	2	930	0
	3	925	0
RETRACT	1	1720	0
	2	1725	0
	3	1725	0

Table 7-7. Post 3000 Cycles Functional Test Data (Specimen 1)

PORT PRESSURIZED	RUN NO.	FORCE DEVELOPED (lbs)	LEAKAGE (scim)
EXTEND	1	930	0
	2	925	0
	3	930	0
RETRACT	1	1715	0
	2	1710	0
	3	1710	0

Table 7-8. Post 4000 Cycles Functional Test Data (Specimen 1)

PORT PRESSURIZED	RUN NO.	FORCE DEVELOPED (lbs)	LEAKAGE (scim)
EXTEND	1	915	0
	2	920	0
	3	920	0
RETRACT	1	1725	0
	2	1725	0
	3	1730	0

Table 7-9. Post 5000 Cycles Functional Test Data (Specimen 1)

PORT PRESSURIZED	RUN NO.	FORCE DEVELOPED (lbs)	LEAKAGE (scim)
EXTEND	1	925	0
	2	925	0
	3	930	0
RETRACT	1	1720	0
	2	1725	0
	3	1730	0

Table 7-10. Pre-Cycle Test Functional Test Data (Specimen .)

PORT PRESSURIZED	RUN NO.	FORCE DEVELOPED (lbs)	LEAKAGE (scim)
EXTEND	1	935	0
	2	940	0
	3	940	0
RETRACT	1	1775	0
	2	1780	0
	3	1780	0

Table 7-11. Post 50 Cycles Functional Test Data (Specimen 2)

PORT PRESSURIZED	RUN NO.	FORCE DEVELOPED (lbs)	LEAKAGE (scim)
EXTEND	1	945	0
	2	950	0
	3	950	0
RETRACT	1	1790	0
	2	1790	0
	3	1795	0

Table 7-12. Post 100 Cycles Functional Test Data (Specimen 2)

PORT PRESSURIZED	RUN NO.	FORCE DEVELOPED (lbs)	LEAKAGE (scim)
EXTEND	1	955	0
	2	960	0
	3	960	0
RETRACT	1	1765	0
	2	1770	0
	3	1770	0

Table 7-13. Post 500 Cycles Functional Test Data (Specimen 2)

PORT PRESSURIZED	RUN NO.	FORCE DEVELOPED (lbs)	LEAKAGE (scim)
EXTEND	1	945	0
	2	950	0
	3	950	0
RETRACT	1	1765	0
	2	1770	0
	3	1770	0

Table 7-14. Post 1000 Cycles Functional Test Data (Specimen 2)

PORT PRESSURIZED	RUN NO.	FORCE DEVELOPED (lbs)	LEAKAGE (scim)
EXTEND	1	945	0
	2	950	0
	3	950	0
RETRACT	1	1760	0
	2	1765	0
	3	1765	0

Table 7-15. Post 2000 Cycles Functional Test Data (Specimen 2)

PORT PRESSURIZED	RUN NO.	FORCE DEVELOPED (lbs)	LEAKAGE (scim)
EXTEND	1	945	0
	2	950	0
	3	950	0
RETRACT	1	1775	0
	2	1775	0
	3	1775	0

Table 7-16. Post 3000 Cycles Functional Test Data (Specimen 2)

PORT PRESSURIZED	RUN NO.	FORCE DEVELOPED (lbs)	LEAKAGE (scim)
EXTEND	1	935	0
	2	940	0
	3	935	0
RETRACT	1	1735	0
	2	1735	0
	3	1735	0

Table 7-17. Post 4000 Cycles Functional Test Data (Specimen 2)

PORT PRESSURIZED	RUN NO.	FORCE DEVELOPED (lbs)	LEAKAGE (scim)
EXTEND	1	940	0
	2	945	0
	3	945	0
RETRACT	1	1725	0
	2	1725	0
	3	1730	0

Table 7-18. Post 5000 Cycles Functional Test Data (Specimen 2)

PORT PRESSURIZED	RUN NO.	FORCE DEVELOPED (lbs)	LEAKAGE (scim)
EXTEND	1	900	0
	2	900	0
	3	900	0
RETRACT	1	1735	0
	2	1740	0
	3	1740	0

Table 7-19. Pre-Cycle Test Functional Test Data (Specimen 3)

PORT PRESSURIZED	RUN NO.	FORCE DEVELOPED (lbs)	LEAKAGE (scim)
EXTEND	1	920	0
	2	915	0
	3	920	0
RETRACT	1	1705	0
	2	1705	0
	3	1700	0

Table 7-20. Post 50 Cycles Functional Test Data (Specimen 3)

PORT PRESSURIZED	RUN NO.	FORCE DEVELOPED (lbs)	LEAKAGE (scim)
EXTEND	1	940	0
	2	940	0
	3	935	0
RETRACT	1	1725	0
	2	1720	0
	3	1725	0

Table 7-21. Post 100 Cycles Functional Test Data (Specimen 3)

PORT PRESSURIZED	RUN NO.	FORCE DEVELOPED (lbs)	LEAKAGE (scim)
EXTEND	1	935	0
	2	935	0
	3	930	0
RETRACT	1	1760	0
	2	1755	0
	3	1750	0

Table 7-22. Post 500 Cycles Functional Test Data (Specimen 3)

PORT PRESSURIZED	RUN NO.	FORCE DEVELOPED (lbs)	LEAKAGE (scim)
EXTEND	1	930	0
	2	930	0
	3	930	0
RETRACT	1	1750	0
	2	1750	0
	3	1745	0

Table 7-23. Post 1000 Cycles Functional Test Data (Specimen 3)

PORT PRESSURIZED	RUN NO.	FORCE DEVELOPED (lbs)	LEAKAGE (scim)
EXTEND	1	925	0
	2	930	0
	3	925	0
RETRACT	1	1745	0
	2	1750	0
	3	1745	0

Table 7-24. Post 2000 Cycles Functional Test Data (Specimen 3)

PORT PRESSURIZED	RUN NO.	FORCE DEVELOPED (lbs)	LEAKAGE (scim)
EXTEND	1	945	0
	2	945	0
	3	945	0
RETRACT	1	1745	0
	2	1745	0
	3	1745	0

Table 7-25. Post 3000 Cycles Functional Test Data (Specimen 3)

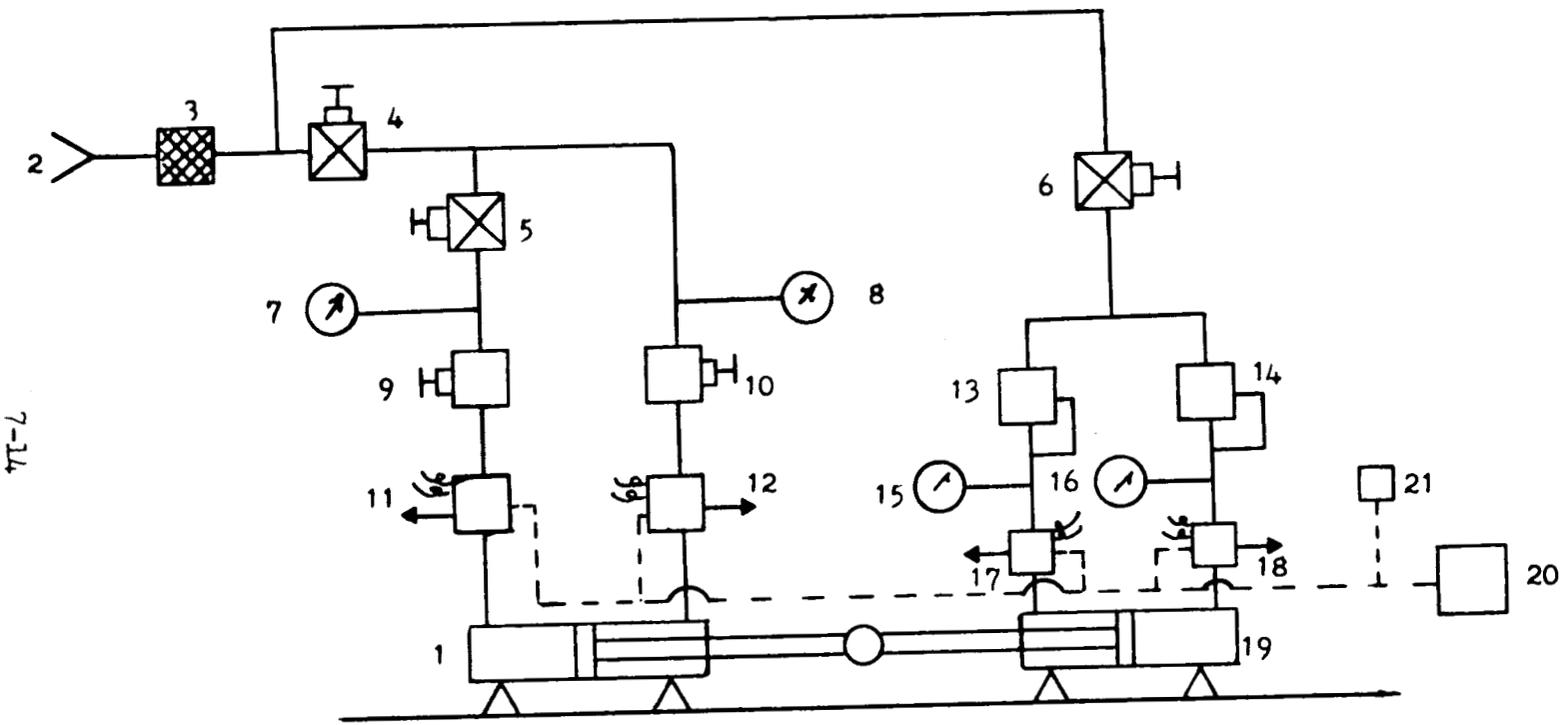
PORT PRESSURIZED	RUN NO.	FORCE DEVELOPED (lbs)	LEAKAGE (scim)
EXTEND	1	925	0
	2	930	0
	3	925	0
RETRACT	1	1740	0
	2	1740	0
	3	1745	0

Table 7-26. Post 4000 Cycles Functional Test Data (Specimen 3)

PORT PRESSURIZED	RUN NO.	FORCE DEVELOPED (lbs)	LEAKAGE (scim)
EXTEND	1	915	0
	2	920	0
	3	920	0
RETRACT	1	1725	0
	2	1720	0
	3	1725	0

Table 7-27. Post 5000 Cycles Functional Test Data (Specimen 3)

PORT PRESSURIZED	RUN NO.	FORCE DEVELOPED (lbs)	LEAKAGE (scim)
EXTEND	1	935	0
	2	930	0
	3	935	0
RETRACT	1	1760	0
	2	1760	0
	3	1750	0



Note: Refer to table 7-1 for item identification

Figure 7-1. Cycle Test Schematic

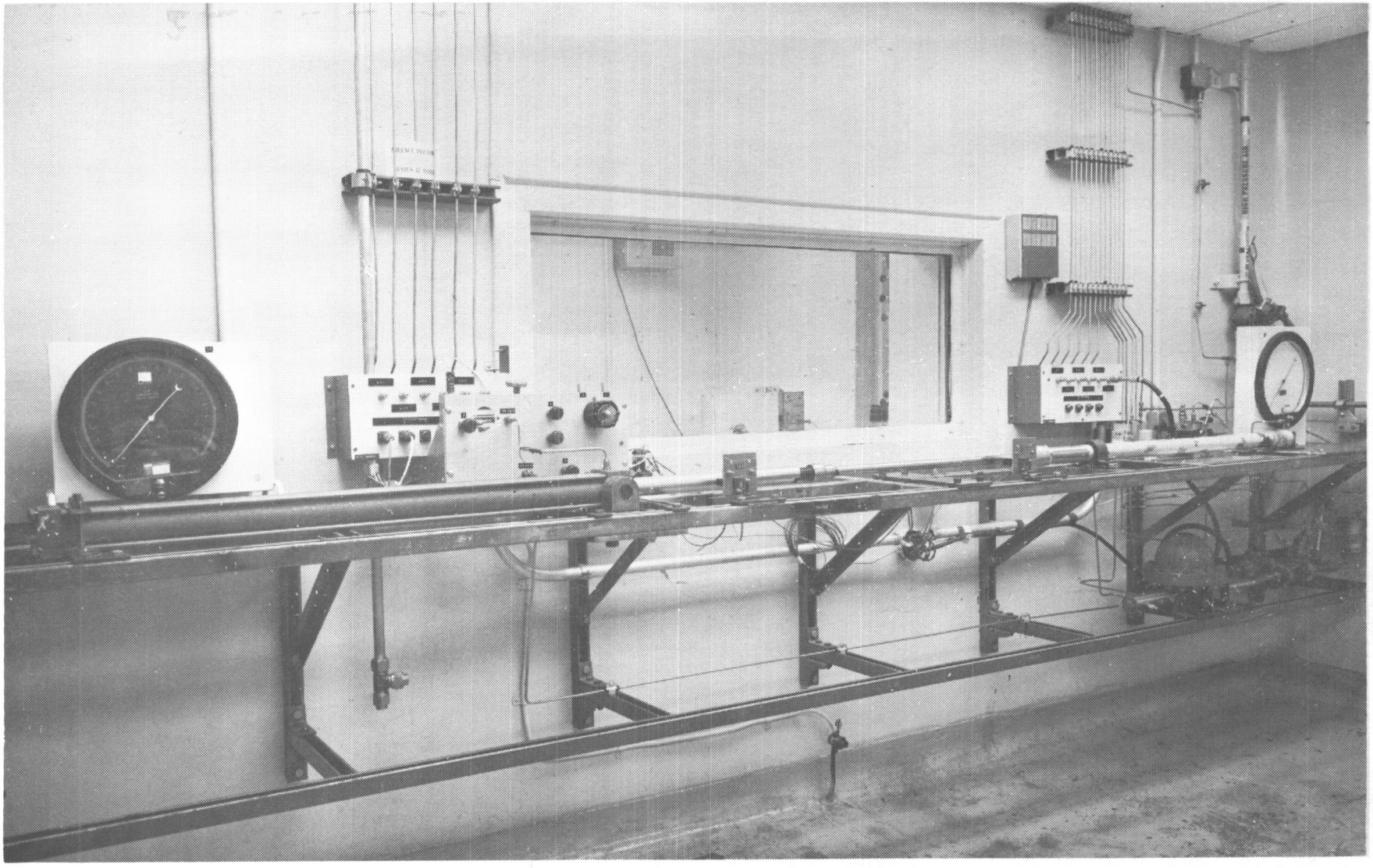


Figure 7-2. Cycle Test Setup

SECTION VIII

BURST PRESSURE TEST

8.1 TEST REQUIREMENTS

8.1.1 A burst pressure test will be performed on test Specimen 1 to determine whether the unit will satisfy minimum burst pressure requirements.

8.1.2 The minimum burst pressure of 3,000 psig shall be maintained for 5 minutes.

8.1.3 A visual inspection shall be made for specimen structural damage and leakage.

8.2 TEST PROCEDURE

8.2.1 Test Specimen 1 was placed in a burst test setup as shown in figure 8-1.

8.2.2 The extend and retract ports of the specimen were hydrostatically pressurized simultaneously to 3,000 psig for 5 minutes.

8.2.3 The specimen was monitored for leakage throughout the test.

8.2.4 The specimen was inspected for structural damage.

8.3 TEST RESULTS

8.3.1 No visible leakage or distortion occurred during the burst test.

8.3.2 Test results were considered satisfactory.

8.4 TEST DATA

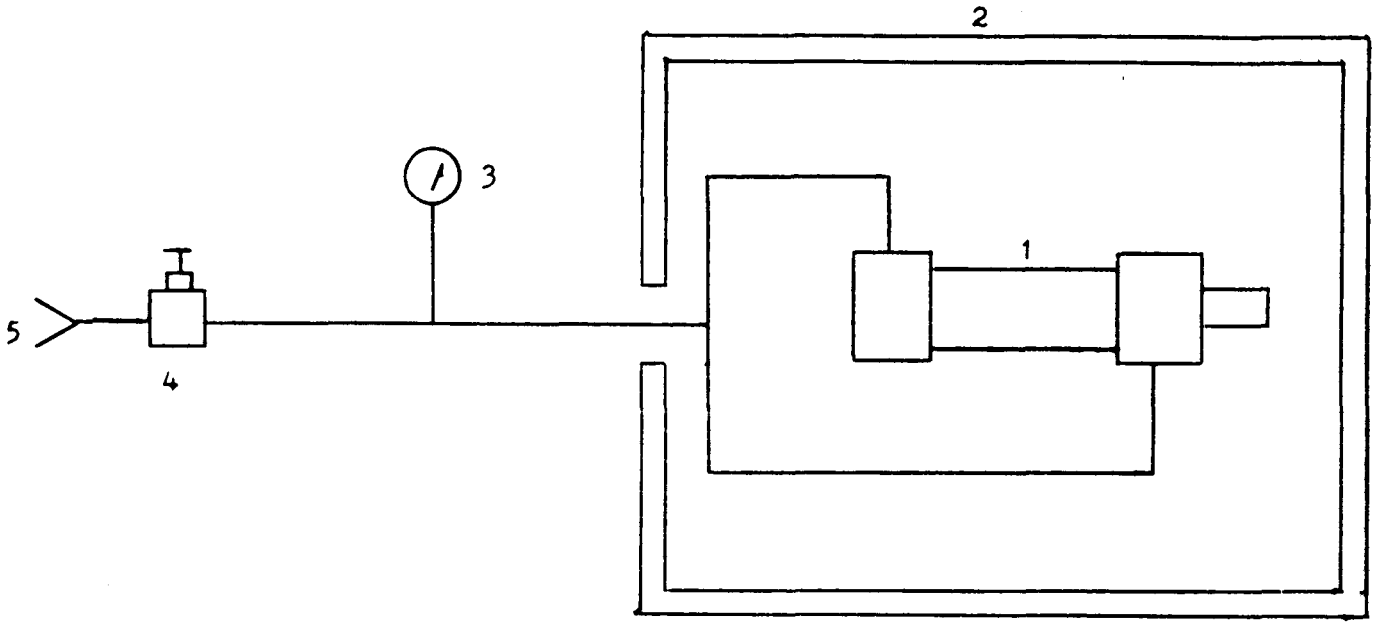
Burst test data are presented in table 8-2.

Table 8-1. Burst Test Equipment List

Item No.	Item	Manufacturer	Model/ Part No.	Serial No.	Remarks
1	Test Specimen	Miller Fluid Power	C14616	1	
2	Burst Chamber	CCSD	NA	201344	
3	Pressure Gage Hydrostatic	Ashcroft	NA	95-1396	0 to 10,000 psig Cal. Date 11-16-67
4	Hand Valve	Aminco	50011A	NA	¼-inch
5	Hydrostatic Pressure Source	Sprague Engineering Corp.	NA	300-1664	

Table 8-2. Burst Test Data

Test Media	H_2O
Pressure	3000 psig
Duration	5 minutes
Leakage	None
Distortion	None



Note: Refer to table 8-1 for item identification.

Figure 8-1. Burst Test Schematic

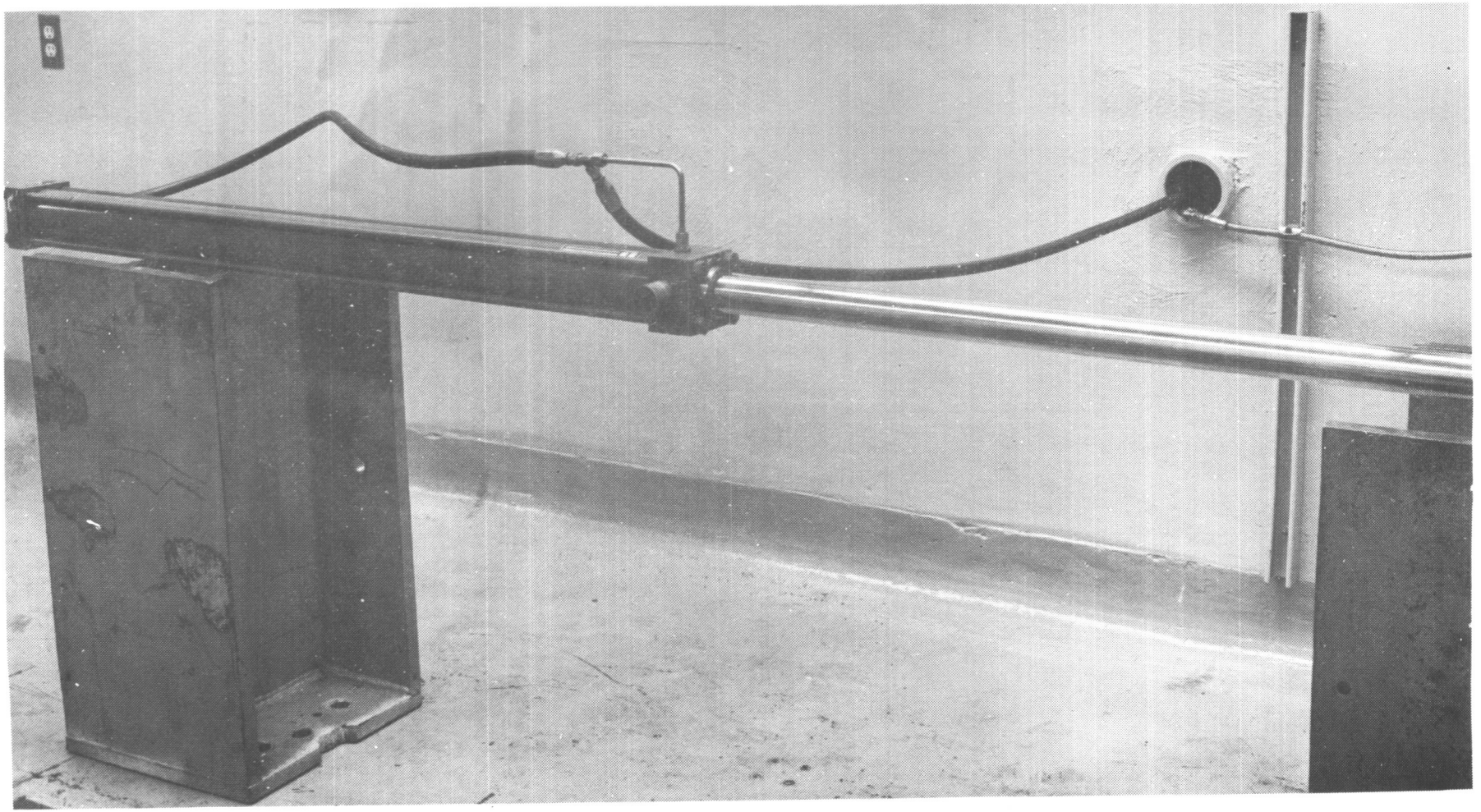


Figure 8-2. Burst Test Setup

APPROVAL

TEST REPORT

FOR

PNEUMATIC CYLINDER

Miller Fluid Power Part Number C14616

NASA Drawing Number 75M06909-1, Revision B

SUBMITTED BY:

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Test and Evaluation Section

APPROVALS:

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Program Supervisor

for:
V. J. Vehko, Director
Engineering Department

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